

National Aeronautics and Space Administration



# NASA Ames Research Center Site Visit IT Infrastructure Integration Program (I<sup>3</sup>P)

Office of the Chief Information Officer

May 11, 2009

VISION: Integrated, secure, and efficient information  
technology and solutions that support NASA



# Agenda

Office of the Chief Information Officer

- Safety and Administrative Information - Chris Maese, ARC I3P Industry Day Point of Contact (POC)
  - Comments and Questions Process
- Center Welcome - Lewis Braxton, Deputy Center Director
- I3P Overview - Chris C. Kemp, Chief Information Officer
- Site Visit Objectives - Chris C. Kemp, Chief Information Officer
- Center Overview - Jack Boyd, Senior Advisor to the Director
- Center IT Infrastructure Today
  - Communications Network System - Grace De Leon
  - Data Center Environment - Mark Savi
  - End User Environment - Ray Obrien
- Center Tour



# Safety Information

Office of the Chief Information Officer

- Evacuation: Should we need to evacuate,  
STAY CALM.
  - Exits: There are 5 exits to the Ballroom.
    - West Side of Building: Two exits which lead to the meeting location in the back parking lot
    - East Side of Building: Three behind you in the direction (East) of the building entrance. As you exit, make a left and exit out the glass door.
  - Meeting Location: Proceed to the parking lot behind the Ballroom (West side of building) and wait for further instruction.
  - Sign-in: Please remember to check-in at the meeting location to be sure you have all been accounted for.



# Administrative Information

Office of the Chief Information Officer

- Restrooms: The restrooms are located to your right (North) of this meeting room. There are also restrooms as you enter the lobby of the building to the right (North).
- Cell phones and pagers: Please adjust all cell phones and pagers to the “Off” or “Vibrate” setting.
- Refreshments:
  - Water is available at the water cooler at the back of the ballroom.
  - Food and drinks will be available for purchase starting at 9:30 am in the West side parking lot.





## Administrative Information (cont.)

Office of the Chief Information Officer

- Tours: The tours will take place on the Research Center.
  - Access to the Center is by Tour bus only (~20 Passengers/bus).
  - All visitors to the center must wear badges that are to be provided. Pick up badges at the registration desk prior to boarding bus.
  - Please do not leave personal items in the ballroom unattended.
  - There will be some steps to climb.
  - Approximately 1/2 mile of walking can be anticipated.



## Administrative Information (cont.)

Office of the Chief Information Officer

- Tours: The tours will take place on the Research Center.
  - Tour schedule:
    - First bus will begin boarding at 11:15am
    - First bus will leave at 11:30 am
    - Second bus will begin boarding at 11:45
    - Second bus will leave at at 12 pm
    - Third bus will begin boarding at at 12:15 pm (if needed)
    - Third bus will leave at 12:30 pm (if needed)
  - Projected length of tour is 1 hour



## Comments and Questions Process

Office of the Chief Information Officer

- Aside from site visit logistics questions, NASA will handle comments and questions as described below:
- Submit comments/questions to <http://I3P.nasa.gov> [Q/A tab].
- Comments Received by May 20:
  - Sender will receive acknowledgement e-mail.
  - Comments will not be posted online nor to any publicly accessible website but will be considered internally by the government when finalizing the RFP and no response will be provided.
- Questions Received by May 20:
  - Sender will receive acknowledgement e-mail.
  - Questions, in whole, in part, or consolidated with similar questions, will be posted online along with the government's response. Individual and company identifiers will not be used in the online posting.



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# ARC Welcome

Office of the Chief Information Officer

**Lewis Braxton,  
ARC Deputy Center Director**



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# I3P Overview

Office of the Chief Information Officer

**Chris C. Kemp,  
ARC Chief Information Officer**



## I<sup>3</sup>P Overview: Why I<sup>3</sup>P?

Office of the Chief Information Officer

- NASA's commitment to the strategy of Agency-wide IT services and Agency-wide procurement aligns with:



- NASA's need for IT security, efficiency, and collaboration for mission support
- Industry and business best practices
- New Administration's priorities of effectiveness, efficiency, transparency, participation and collaboration

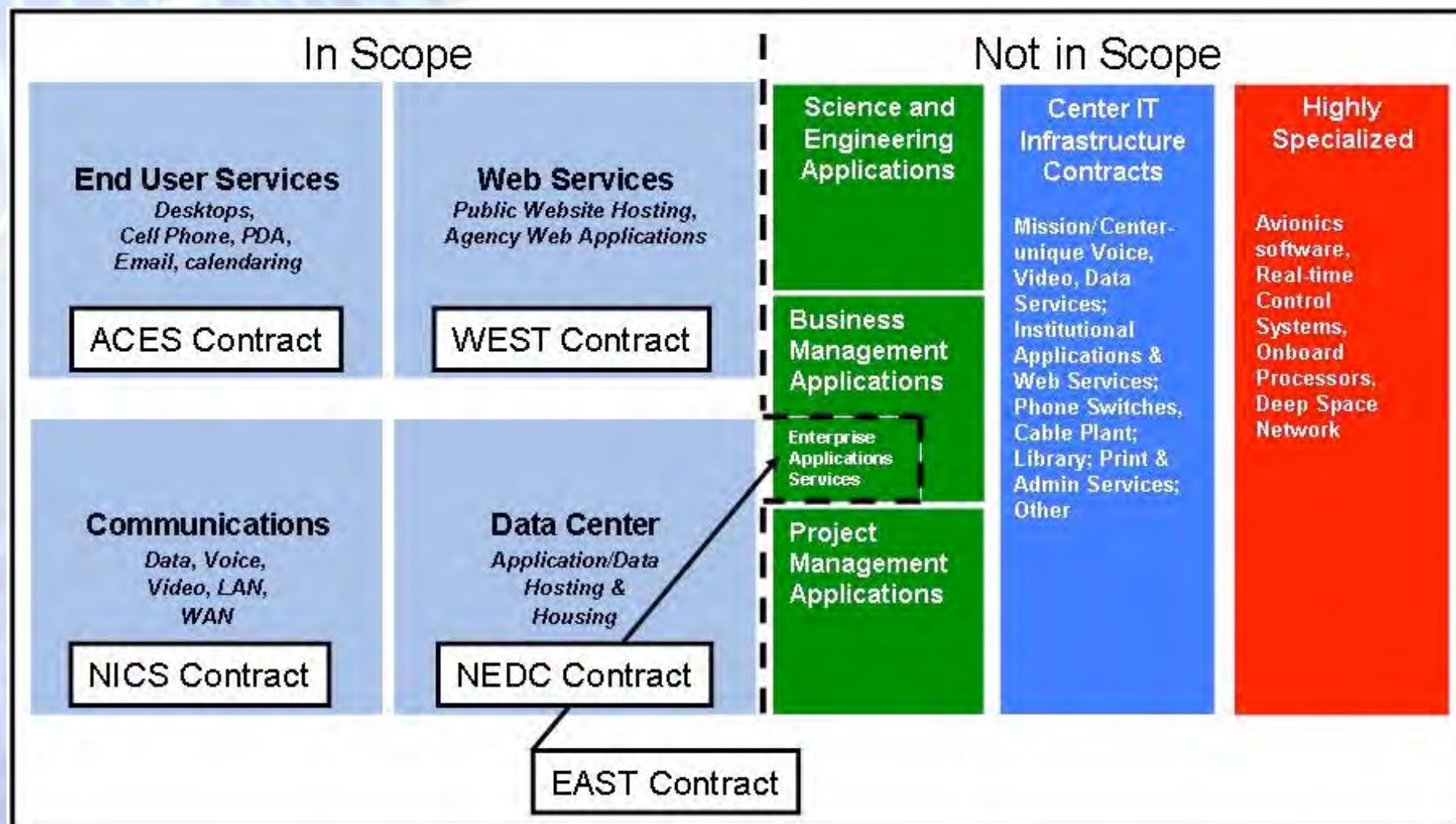
- What will success look like?
  - Reliable, efficient, secure, and well-managed IT infrastructure that customers rely on
  - Systems seamlessly deployed and used across Centers
  - Investing in the right IT solutions that provide the greatest benefit to the NASA mission





# I<sup>3</sup>P Overview: Five Procurements Drive NASA's IT Transformation

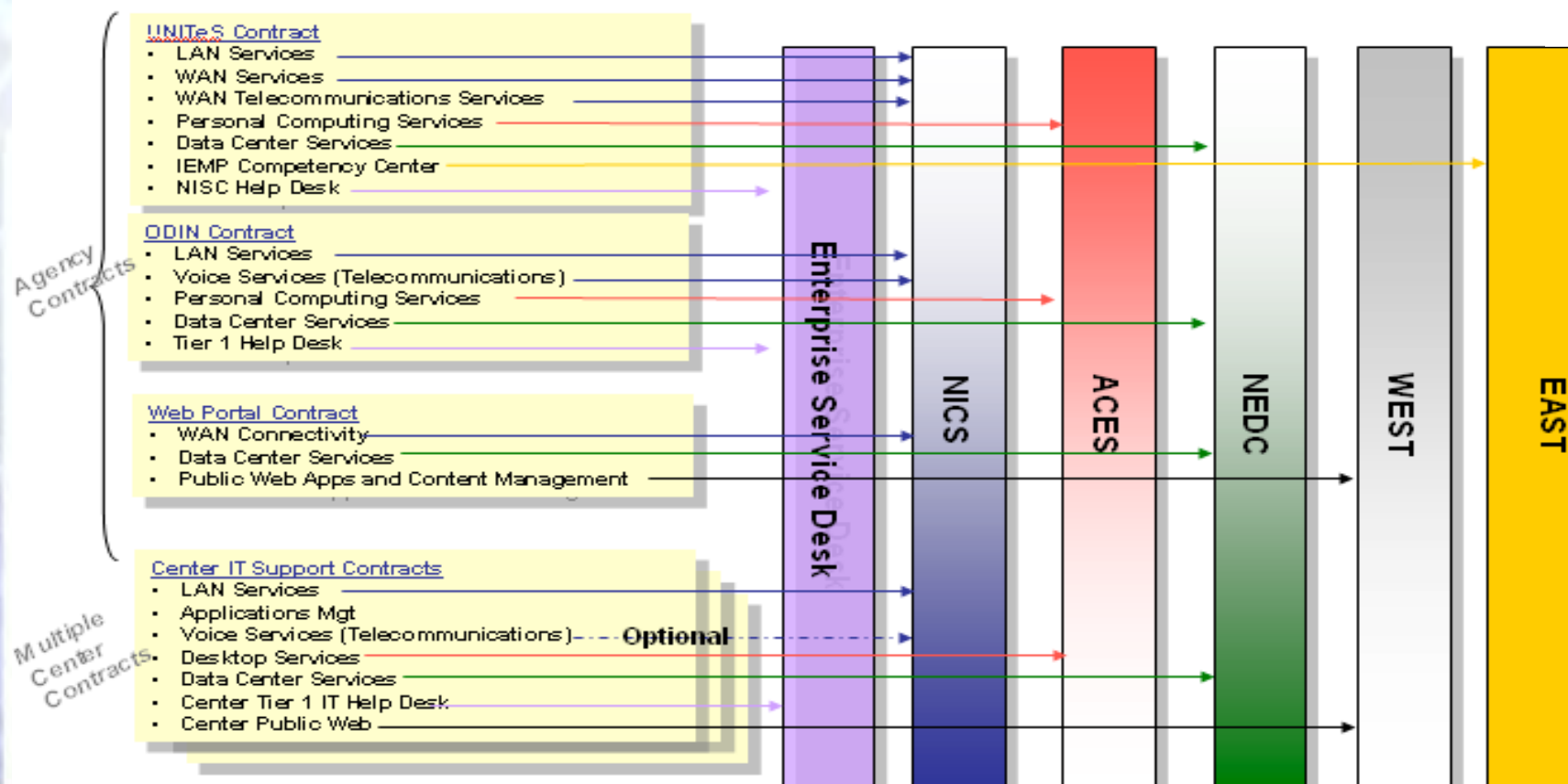
Office of the Chief Information Officer





# I<sup>3</sup>P Overview: Agency IT Infrastructure Supports Transformation

- Consolidates and requires Centers to use Agency contracts for core IT infrastructure services
- Allows Centers to use Center specific IT support contracts for Non-I<sup>3</sup>P services
- Uses a single Enterprise Service Desk and Enterprise Service Request System for reporting/tracking Incidents and for requesting I<sup>3</sup>P defined services
- Primary purpose is to provide better IT security, collaboration, efficiencies to accomplish NASA mission





## I<sup>3</sup>P Overview: Efforts Under Way

Office of the Chief Information Officer

- Making NASA's information easier to discover and safely access through current projects (e.g., Security Ops Center)
- Continuing consolidation of NASA's information technology (IT) through current contracts and projects (e.g., ODIN, NOMAD)
- Working procurements for Agency-wide IT services:
  - **NICS** will integrate networks and provide seamless operations across Centers;
  - **NEDC** will improve availability and access to applications and data;
  - **WEST** will improve the quality of web services for the same cost;
  - **ACES** will provide a consistent level of IT services across NASA; and
  - **EAST** will enable more efficient development and maintenance of Agency-wide applications, as well as improve the availability of business information for better informed decision making.
  - Enterprise Service Desk at NSSC will provide a single point of contact for IT incident and problem resolution and I<sup>3</sup>P service ordering





## I<sup>3</sup>P Overview: Procurement Schedule

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Updated April 22, 2009					
Milestones	NICS	ACES	NEDC	WEST	EAST
Draft RFP	4/20/09	4/20/09	4/20/09	4/20/09	5/11/09
Industry Days	4/21 and 4/22	4/21 and 4/22	4/21 and 4/22	4/21 and 4/22	4/21 and 4/22
Due Diligence	5/1 to 5/15 – Primary focus is on ACES, NEDC and NICS. NOTE: The EAST site visit will be on 5-20 at MSFC.				
RFP Release *	6/15/2009	6/15/2009	6/15/2009	6/15/2009	6/15/2009
Proposals Due *	7/30/2009	7/30/2009	7/30/2009	7/30/2009	7/30/2009
Contract Start *	May 2010	June 2010	May 2010	June 2010	May 2010

\* Dates reflect current schedule posted online.





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# Site Visit Objectives

Office of the Chief Information Officer

- What we are planning to do
  - Explain the Center: facilities & people (who we are)
  - Explain involvement with major programs, projects, and missions (what we do)
  - Explain the current state of IT infrastructure at the Center
    - End-user services (desktop/laptop/workstations)
    - Communications (networks, phones)
    - Data centers
- What we are NOT planning to do
  - Explain further the five I<sup>3</sup>P acquisitions or associated strategy
  - Explain the content of the draft RFPs
  - Entertain questions on the acquisition strategy or draft RFPs
  - Discuss future state/plans for Center IT infrastructure



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# Center Overview

Office of the Chief Information Officer

**Jack Boyd**  
**Senior Advisor to ARC Director and ARC**  
**Historian**





# **NASA Ames Research Center Overview**

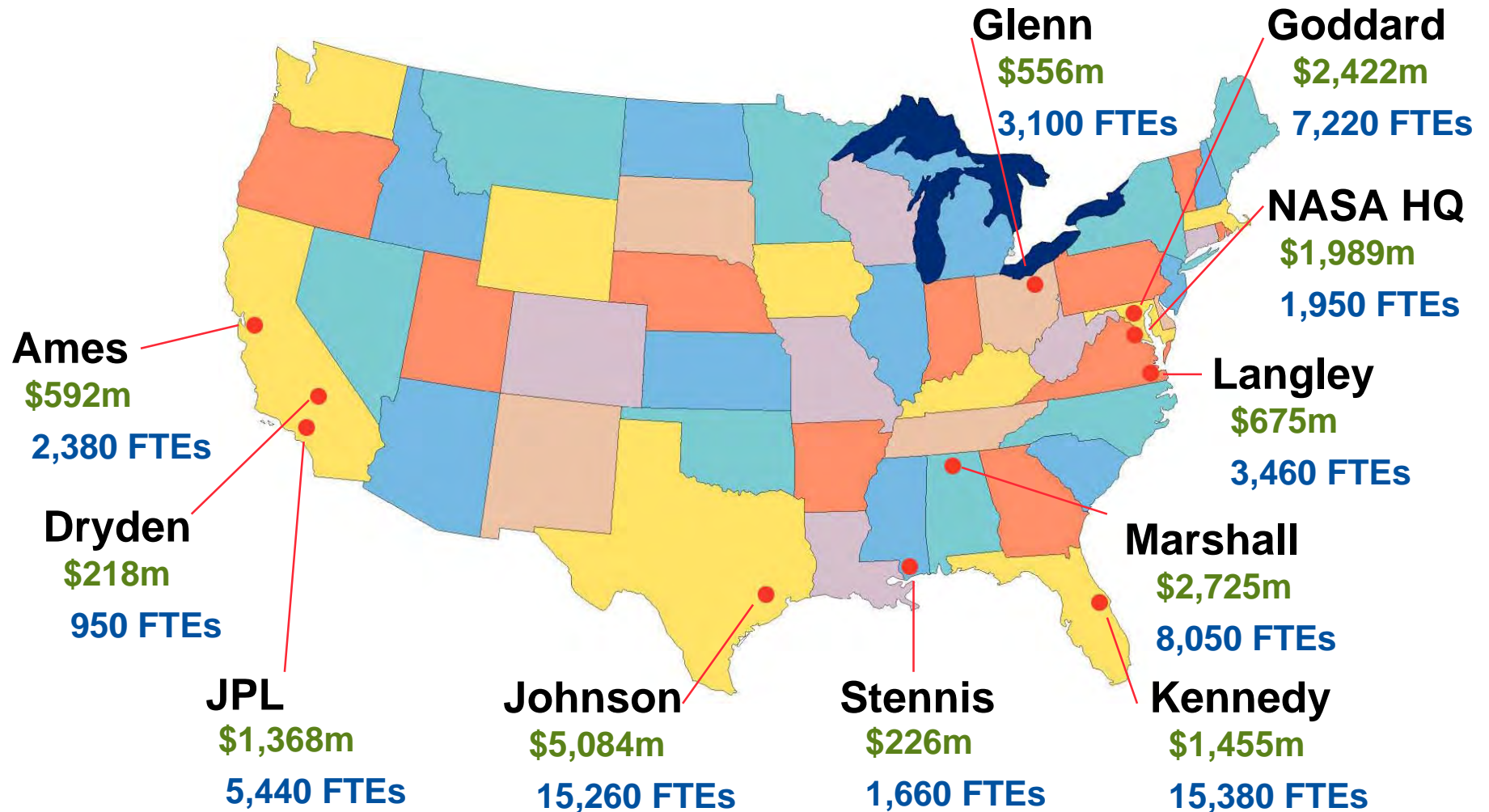
**I3P Industry Day  
May 11, 2009**



**John W. Boyd, Senior Advisor to Director  
NASA Ames Research Center in Silicon Valley**



## Current NASA Field Centers



\*Estimated \$ in millions for FY2008

\*\*Workforce data as of June 2006; includes civil servants and contractors

Revised  
June 2007



Ames Research Center *in Silicon Valley*



## National Advisory Committee for Aeronautics (NACA) Laboratories

**NACA**



Joseph S. Ames

**NASA**

**Ames**

**Dryden**

**Langley**

**Lewis**







## First Century of Flight, Ames Visitors



Charles Lindbergh



Orville Wright



Neil Armstrong



Chuck Yeager



Wernher Von Braun



John Glenn




Jimmy Doolittle



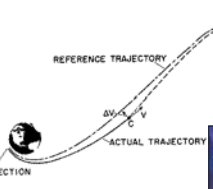
Edward Teller






Tektites

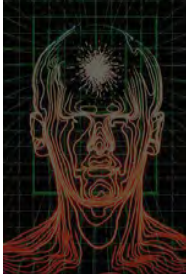
## Seven Decades of Innovation



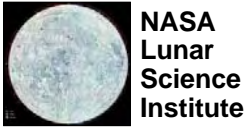
Apollo Guidance System



X-36




Human Centered Computing



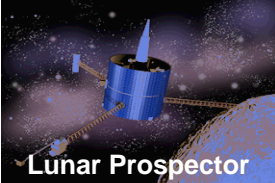
NASA Lunar Science Institute

2010




SOFIA

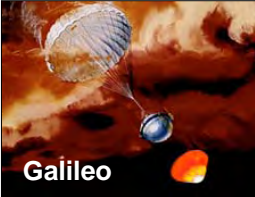
2000



Lunar Prospector




Pioneer




Galileo

1990

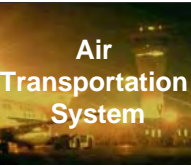


Viking

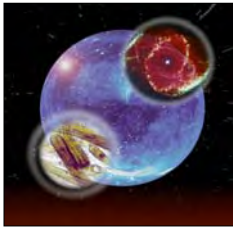
1980




Pioneer Venus



Air Transportation System




Astrobiology




NASA Research Park


1970



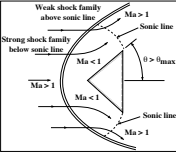
Kepler



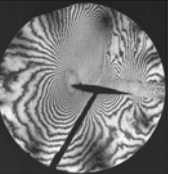
LCROSS




Flight Simulator



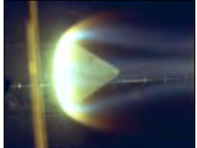
Blunt Body Concept




Transonic Flow




Lifting Body




Apollo Heat Shield Tests




Flight Research




Life Sciences Research



Tiltrotor




Kuiper Observatory




ER-2

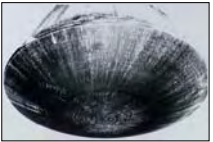
1960




80x120 Wind Tunnel



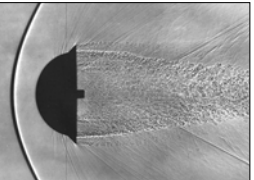
Conical Camber




Apollo Re-Entry Shape



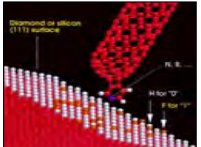
CFD



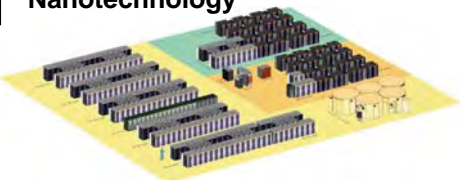
Hypervelocity Free Flight



Arcjet Research



Nanotechnology



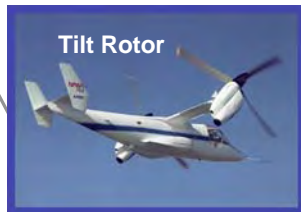
One of the World's Fastest Operational Supercomputers



## Ames Projects



Space Station Biological Research



Infrared Astronomy Satellite



Galileo Probe



SOFIA



A Search For Habitable Planets



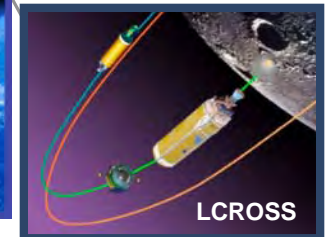
M2-F2



Pioneer Venus



Lunar Prospector



LCROSS



Biosatellite



Cosmos / Bion



Viking Life Detection Experiment



Psychology Systems Experiment



Neurolab

1960

1970

1980

1990

2000





Ames Research Center *in Silicon Valley*



## NASA Ames Research Center Today

- Science (Earth-Life-Space)
  - Astrobiology
  - Science Missions
  - Exploration Systems
  - Small Satellites
  - Aviation and Aeronautics
  - Innovative Collaborations
- 
- 2400+ Employees
  - \$700+ M Annual Budget



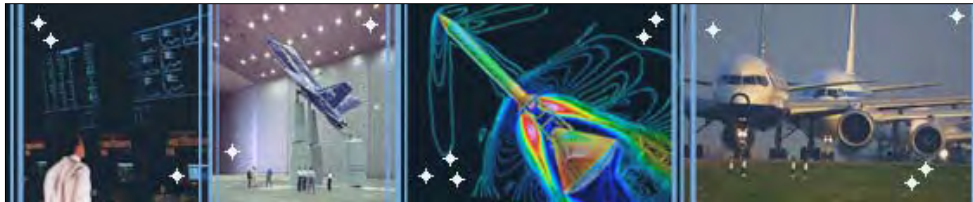




# Ames Research Center *in Silicon Valley*



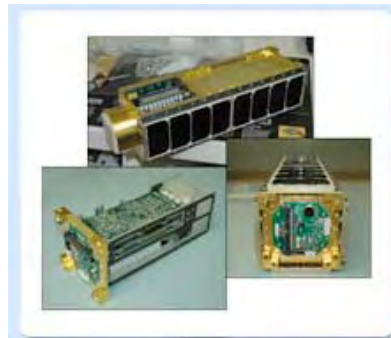
## Ames Technology Areas



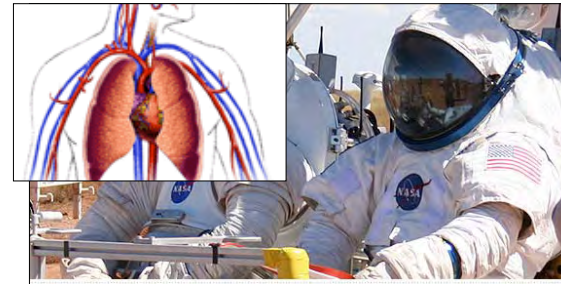
**Aerospace and Aeronautics**



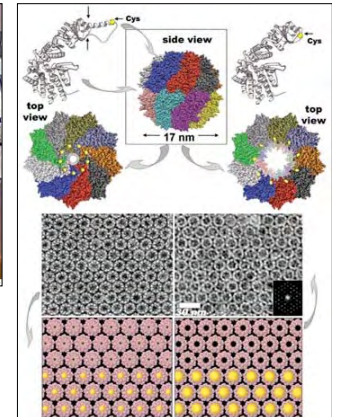
**Integrated Systems Health Management (ISHM)**



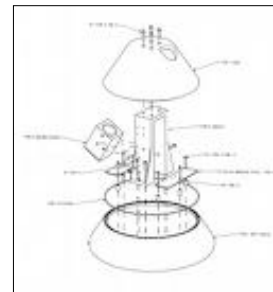
**Small Satellite Systems**



**BioTech/Biomedical**



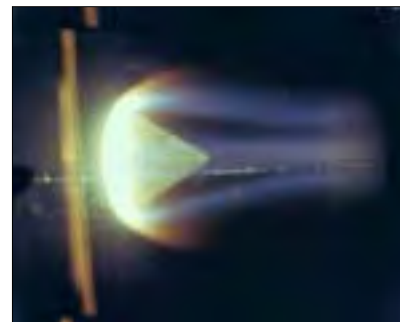
**Nanotechnology**



**Systems Engineering and Design**



**Robotics and Artificial Intelligence**



**Materials Science and Entry Systems**

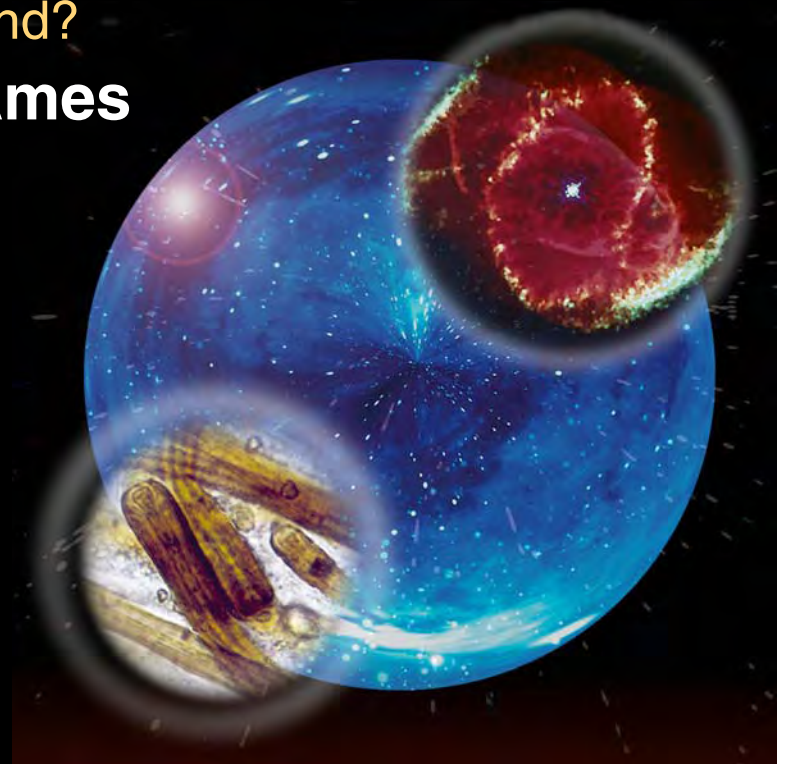


**Software and High-end Computing**



## Astrobiology

- **Scientific Study of Life in the Universe**
- **Three Fundamental Questions**
  - How does life begin and evolve?
  - Does life exist elsewhere in the universe?
  - What is life's future on Earth and beyond?
- **NASA Astrobiology Institute at Ames**
  - Dr. Carl Pilcher, Director
  - 12 Lead Member Institutions
  - 6 International Partners







Ames Research Center *in Silicon Valley*



## NASA Lunar Science Institute (NLSI)

NASA  
**LUNAR SCIENCE**  
INSTITUTE



Established March 2008. David Morrison, Interim Director.

### NASA LUNAR SCIENCE INSTITUTE **THE SCIENCE**

- 1 **OF THE MOON:** Investigations of the nature and history of the Moon (including research on lunar samples) to learn about this specific object and thereby provide insights into the evolution of our solar system.
- 2 **ON THE MOON:** Investigations of the effects of the lunar environment on terrestrial life and the equipment that supports lunar inhabitants; and the effects of robotic and human presence on the lunar environment.
- 3 **FROM THE MOON:** Use of the Moon as a platform for performing scientific investigations, including observations of the Earth and other celestial phenomena that are uniquely enabled by being on the lunar surface.

### NASA LUNAR SCIENCE INSTITUTE **MISSION**

Advance the field of lunar science by:

- 1 carrying out and supporting collaborative research in lunar science, investigating the Moon itself and using the Moon as a unique platform for other investigations;
- 2 providing scientific and technical perspectives to NASA on its lunar research programs, including developing investigations for current and future space missions;
- 3 supporting development of the lunar science community and training the next generation of lunar science researchers; and
- 4 supporting Education and Public Outreach by providing scientific content for K-14 education programs, and communicating directly with the public.



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## Science Missions

- **History of Successful Mission Management**
- **40 Years of Airborne Astronomy**
- **Stratospheric Observatory For Infrared Astronomy (SOFIA)**
- **Kepler Mission - Search for Habitable Planets**
- **Lunar Crater Observation and Sensing Satellite (LCROSS)**
- **Near Earth Objects**

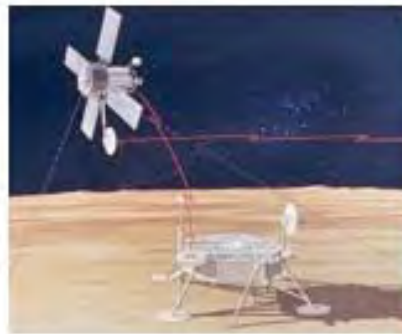


## History of Successful Mission Management



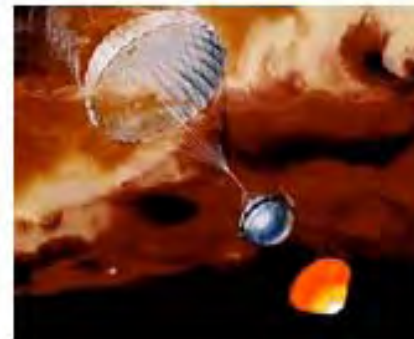
### **The Pioneer 6-11 and Pioneer Venus Program 1965-2003 :**

A series of projects  
considered models of  
science driven, cost  
effective missions



### **Viking Landers 1976 :**

Life Detection  
experiments



### **Galileo Probe 1995 (entry):**

Entered Jovian  
atmosphere to return first  
data ever of the interior of  
Jupiter



### **Lunar Prospector 1995-1999:**

Discovery class mission  
returned global mapping  
data of the Moon's  
gravity and resources,  
including water ice at  
both poles

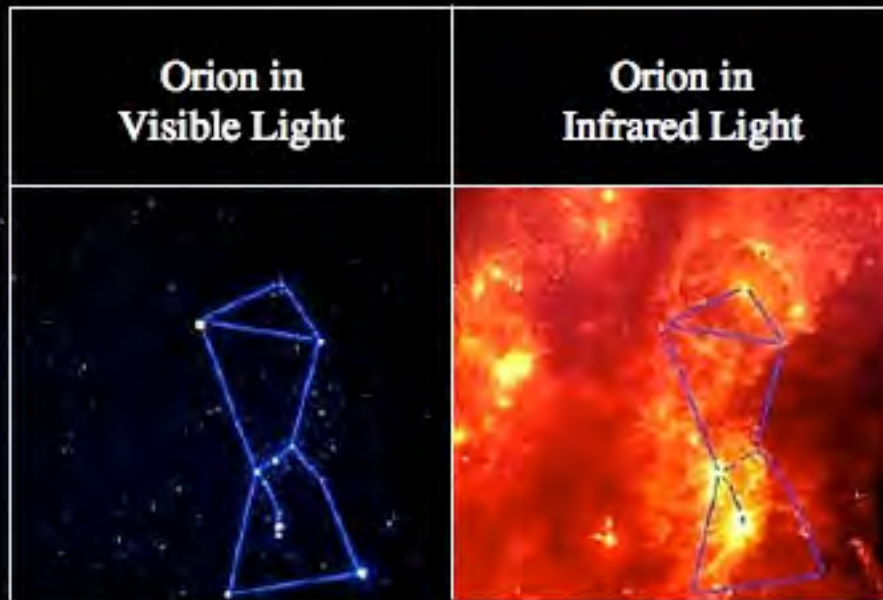




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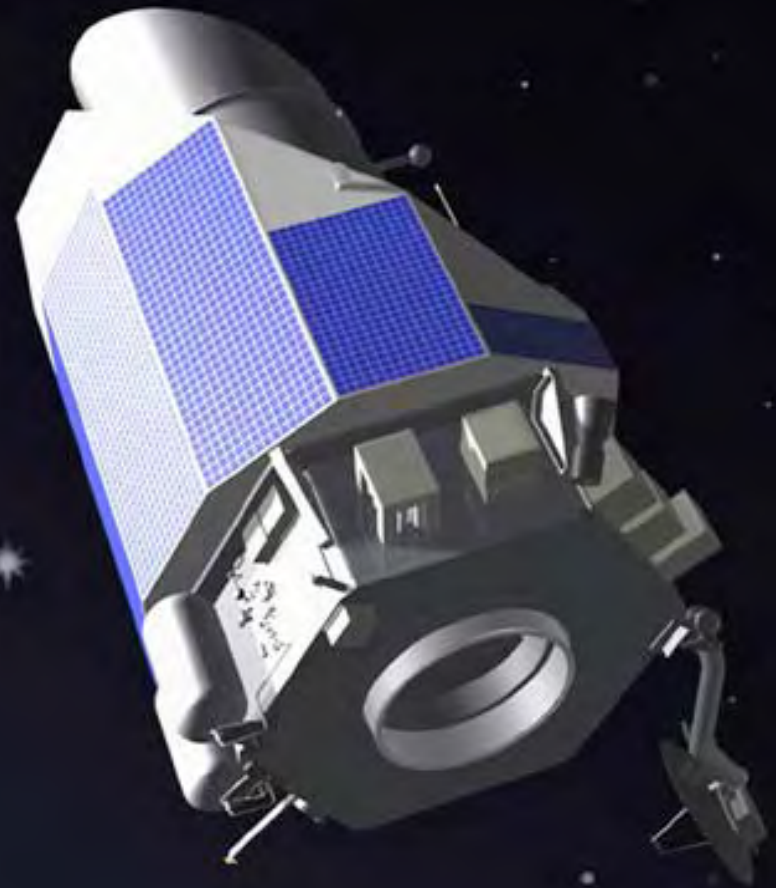
## 40 Years of Airborne Astronomy (1965 - 2005)





## Kepler: The Search for Habitable Planets

- Search for Earth-size and smaller planets in orbit around stars in our galactic neighborhood
- March 2009 Launch







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## **Lunar Crater Observation and Sensing Satellite (LCROSS)**

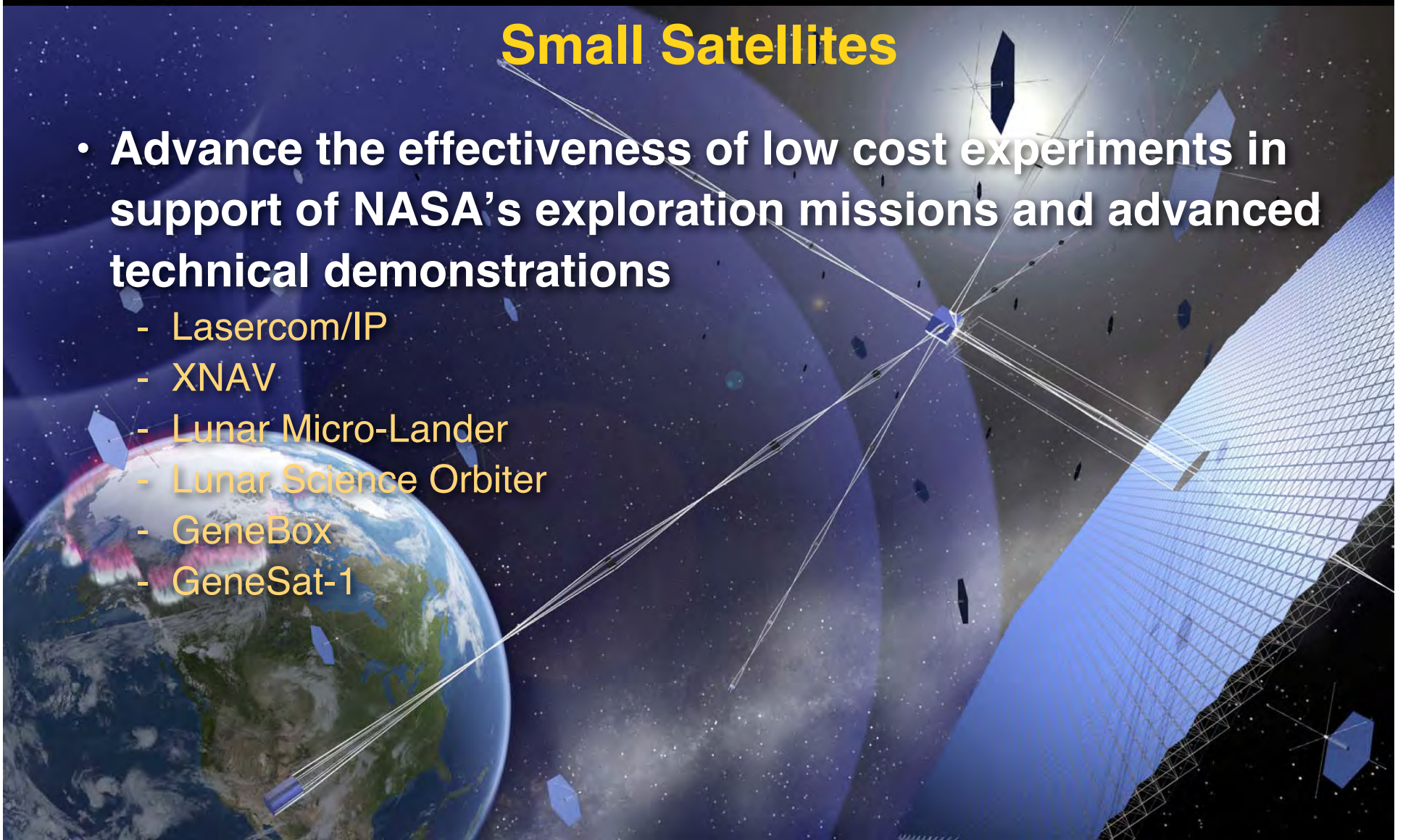
- **Lunar Kinetic Impactor Mission employed to reveal the presence and nature of water ice on the Moon**
- **LCROSS piggy backing on Lunar Reconnaissance Orbiter**
- **May 2009 launch**





## Small Satellites

- Advance the effectiveness of low cost experiments in support of NASA's exploration missions and advanced technical demonstrations
  - Lasercom/IP
  - XNAV
  - Lunar Micro-Lander
  - Lunar Science Orbiter
  - GeneBox
  - GeneSat-1







## Exploration Systems

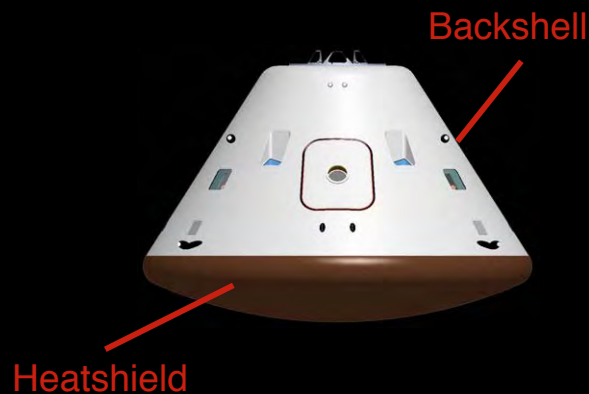
- Thermal Protection Systems
- Mission Operations
- Integrated Systems Health Management
- Software Deliverables to Missions
- Information Technology (Autonomy, Human Factors)
- Super Computing





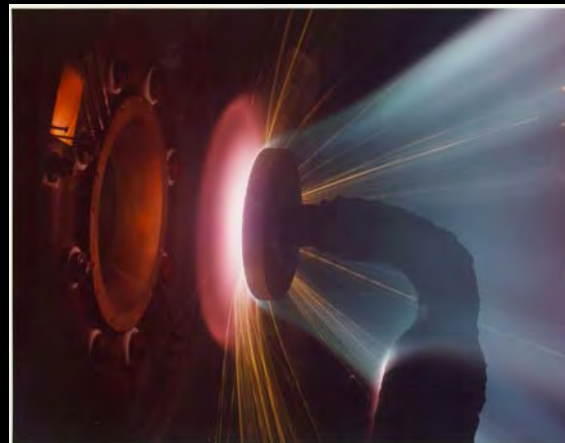
## Thermal Protection Materials and Arc-Jet Facility

- ARC leads development of Orion's thermal protection system
- Testing and/or materials for all US planetary atmospheric entry systems; Support for Apollo, Shuttle, and Crew Exploration Vehicle



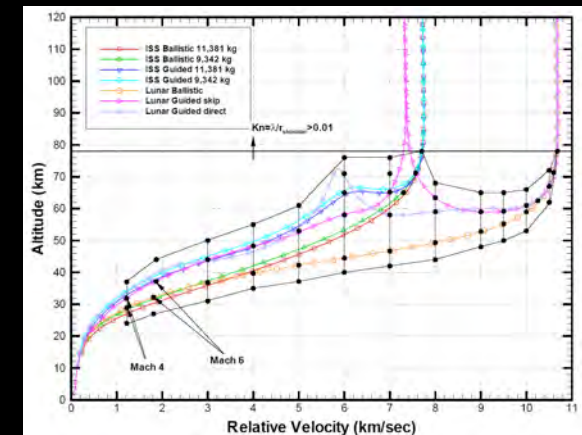
### Design

Lunar Direct Return & Low Earth  
Orbit heat shield



### Testing

Ablative Thermal Protection



### Analysis





## Air Traffic Management/Air Traffic Control

- Traffic Management Advisor (TMA) has had significant positive impact on the National Airspace System (NAS)
- Estimated annual savings of \$400M/year to airlines





## Information Technology

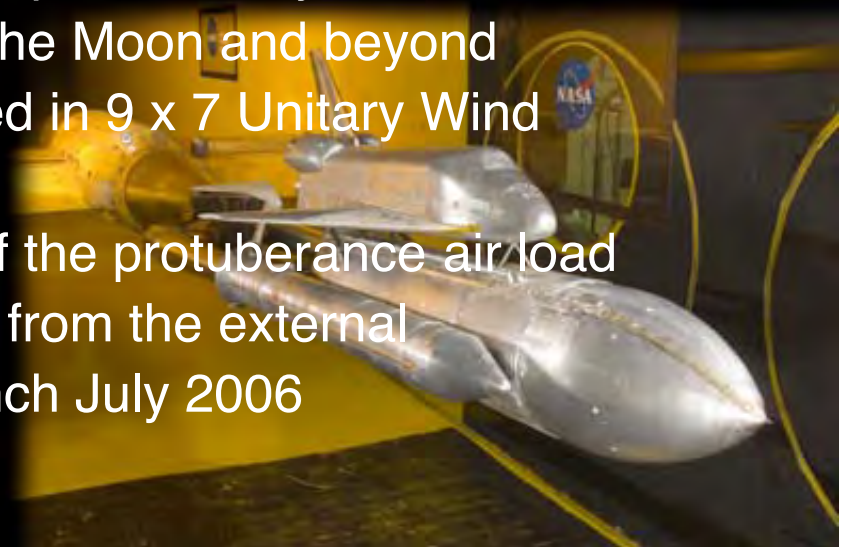
- **Intelligent Adaptive Systems**
  - Autonomous systems and robotics
  - Integrated Systems Health Management
  - Robust software systems
- **Super Computing, Large Data Sets & Datamining**
  - High-end computing resources, integrated with modeling and simulation, data analysis, and visualization technologies
- **ARC provides overall management of Information Technology systems for Constellation**





## Wind Tunnels

- **Space transportation vehicles require significant wind tunnel testing to address configuration development for planetary exit and reentry challenges**
  - Scale model CEV tested in 11 x 11 Unitary Wind Tunnel Complex (March, 2006)
    - CEV will be NASA's new spaceship that will fly astronauts to the International Space Station, the Moon and beyond
  - Space Shuttle 3% scale model tested in 9 x 7 Unitary Wind Tunnel Complex (March, 2006)
    - Provided data to aid in deciding if the protuberance air load (PAL) ramps should be removed from the external tank for the STS-121 shuttle launch July 2006







Ames Research Center *in Silicon Valley*

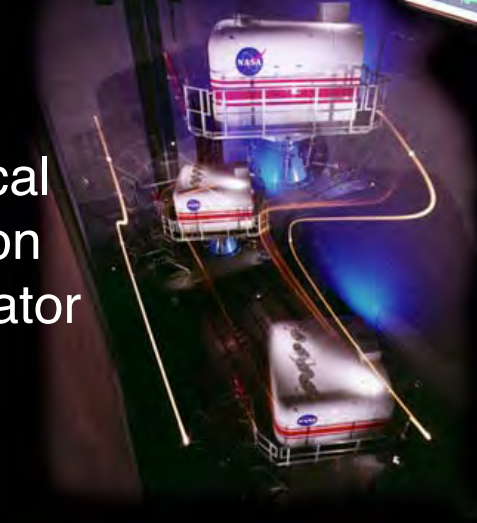


## Simulators

Future Flight Central



Vertical  
Motion  
Simulator



Crew-Vehicle  
Systems  
Research Facility



**NASA Research Park**  
**Innovative Collaboration in Science, Engineering & Education**

Map showing various research centers and buildings:

- UAV Center
- KSTC
- M2MI
- UNCFSP
- Industry Partners
- CMU
- UC
- Space Tech Ctr
- SJSU
- Bloom Energy
- Foothill DeAnza

Buildings are numbered 1 through 19. A legend indicates that buildings 7, 8, 18, and 19 are "Under Development".

**40+ Partners Today:**

- Google-North East section
- University of California/UARC-Building 555
- M2MI Corporation-Building 19
- Carnegie Mellon University-Graduated the 3rd class
- San Jose State University-Metropolitan Technology Center in Building 583C
- Foothill-De Anza Community College-Signed agreement
- United Negro College Fund Special Programs Corporation-Building 19
- Space Technology Center-San Jose State, Stanford, Santa Clara Univ., Utah State Univ. /Micro Satellite Classes
- Kentucky Science & Technology Corporation-Building 19
- Bloom Energy-Building 543 (Fuel Cell Research)
- Industry Partners-Building 566 & 19
- UAV Center-Building 18

– Under Development

## Google-North East section

## M2MI Corporation-Building 19

## Carnegie Mellon University-Graduated the 3rd class

**San Jose State University-Metropolitan Technology Center in Building 583C**

## Foothill-De Anza Community College-Signed agreement

**United Negro College Fund Special Programs Corporation-Building 19**

**Space Technology Center-San Jose State, Stanford, Santa Clara Univ., Utah State Univ. /Micro Satellite Classes**

**Kentucky Science & Technology Corporation-Building 19**

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## Industry Partners-Building 566 & 19

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# Ames Research Center *in Silicon Valley*

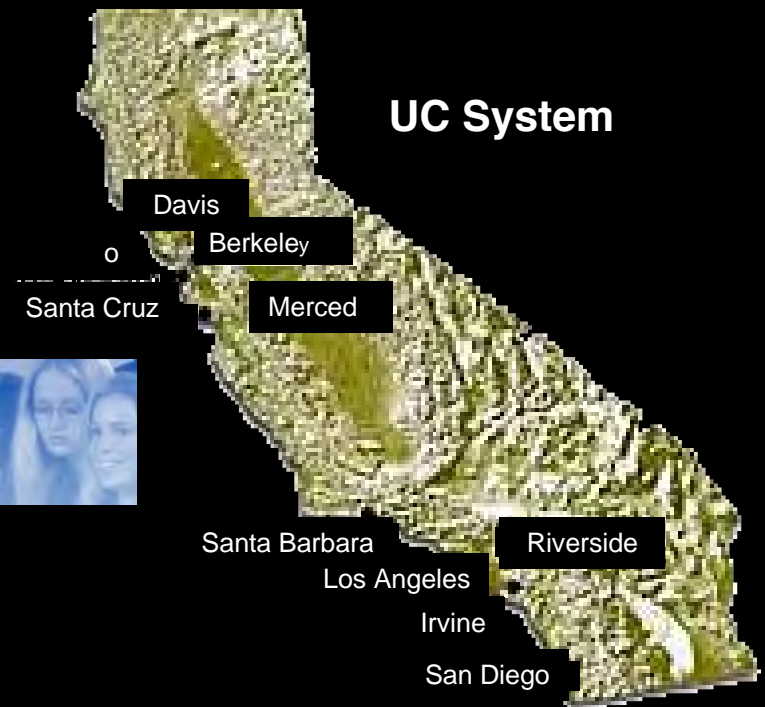


## University Affiliated Research Center (UARC)

- 10 year, \$330 M contract between NASA Ames and University of California
- UC Santa Cruz is lead UC institution-Ranked 1st in Space Science by ISI
- Beyond grants and support contracts
- Tasks that are part of NASA's critical milestones
- Flexibility to change tasks as needs arise
- UC: 10 Campuses, 3 National Laboratories
- \$18B annual budget
- 4 UC campuses rated among top 15 worldwide

### 5 Northern California Campuses

**University of California**  
*It Starts Here*







## Space Portal

- **NASA partnerships to explore collaboration in space launch systems and payloads launched from aircraft**
  - NASA Ames will become a West Coast 'space portal' for affordable small satellites and other scientific and commercial payloads
  - Areas of collaboration to include mission, vehicle, and payload concept analyses; systems engineering; and payload integration, as well as use of NASA Ames' facilities, such as its wind tunnels, arc-jet facility, flight simulators, hangars and runways





# Ames Research Center *in Silicon Valley*



## NASA Ames Educational Activities



Student Space Biology  
Research Program (Ames  
PAO Education Program)



Minority University Research  
and Education Program (MUREP)



Summer High School  
Apprentice Research  
Program (SHARP)



JASON Project



NASA Explorer Schools



Foothill DeAnza  
Internship Program

Ames  
Cooperative  
Education  
Programs

Stanford  
Visiting  
Professors  
Programs



Ames Exploration Encounter



Robotics Alliance Project



Aero Expo



First MOU with Santa  
Clara University



California Academic  
Partnership Program

1950

1960

1970

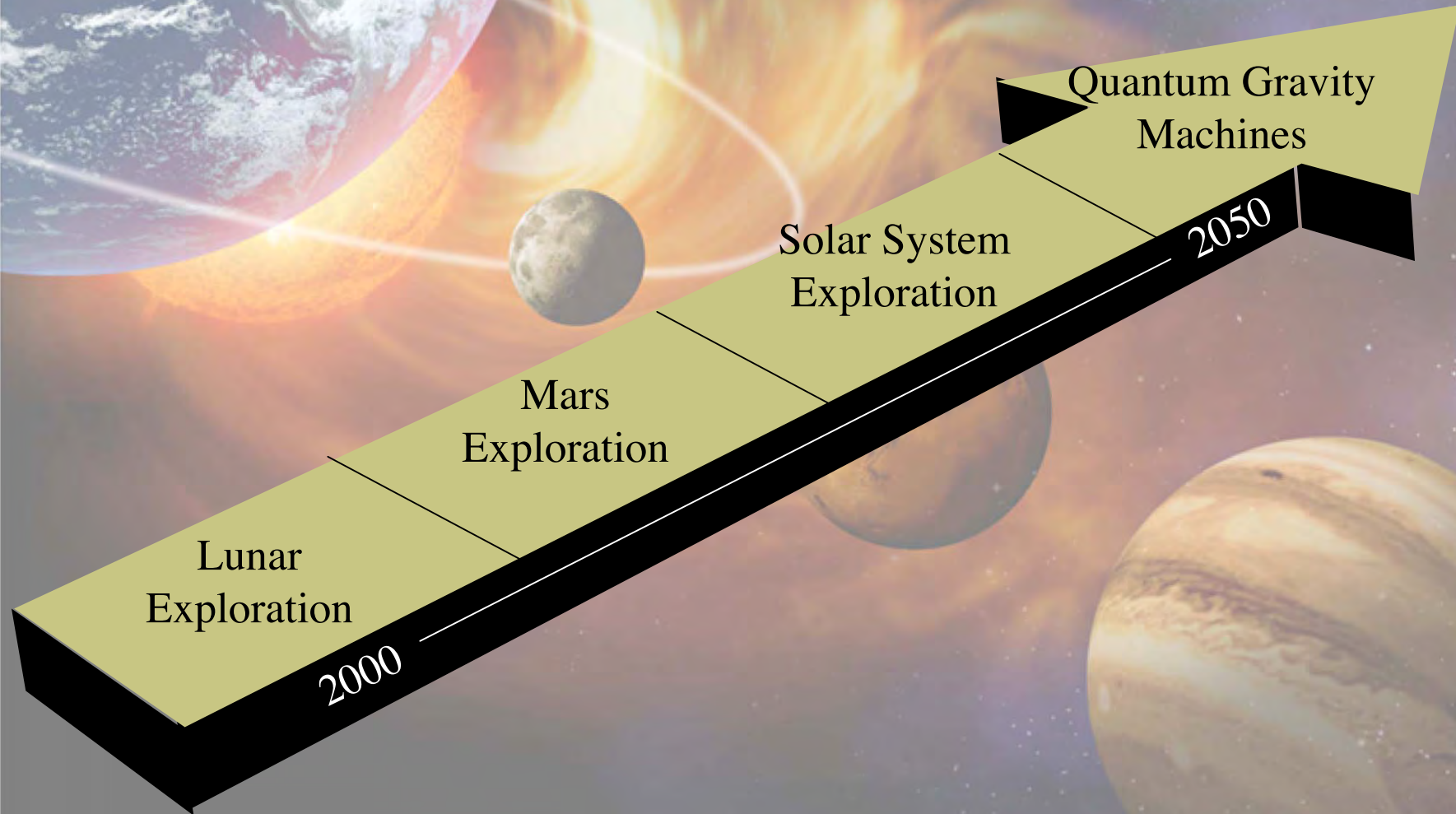
1980

1990

2000



# Next 50 Years - It's Up To Us



?



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  - Communications Network System - Grace De Leon
  - Data Center Environment - Mark Savi
  - End User Environment - Ray Obrien
- Center Tour



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## Center IT Architecture Today

Office of the Chief Information Officer

# ARC Communications Network System

**Grace De Leon**

Acting Chief, IT Operations Division



# ARC Communications Network Primary Components

Office of the Chief Information Officer

- ARCLAN Element
- Voice Element
- Video Element
- RF Radio Element



# ARCLAN Overview

Office of the Chief Information Officer

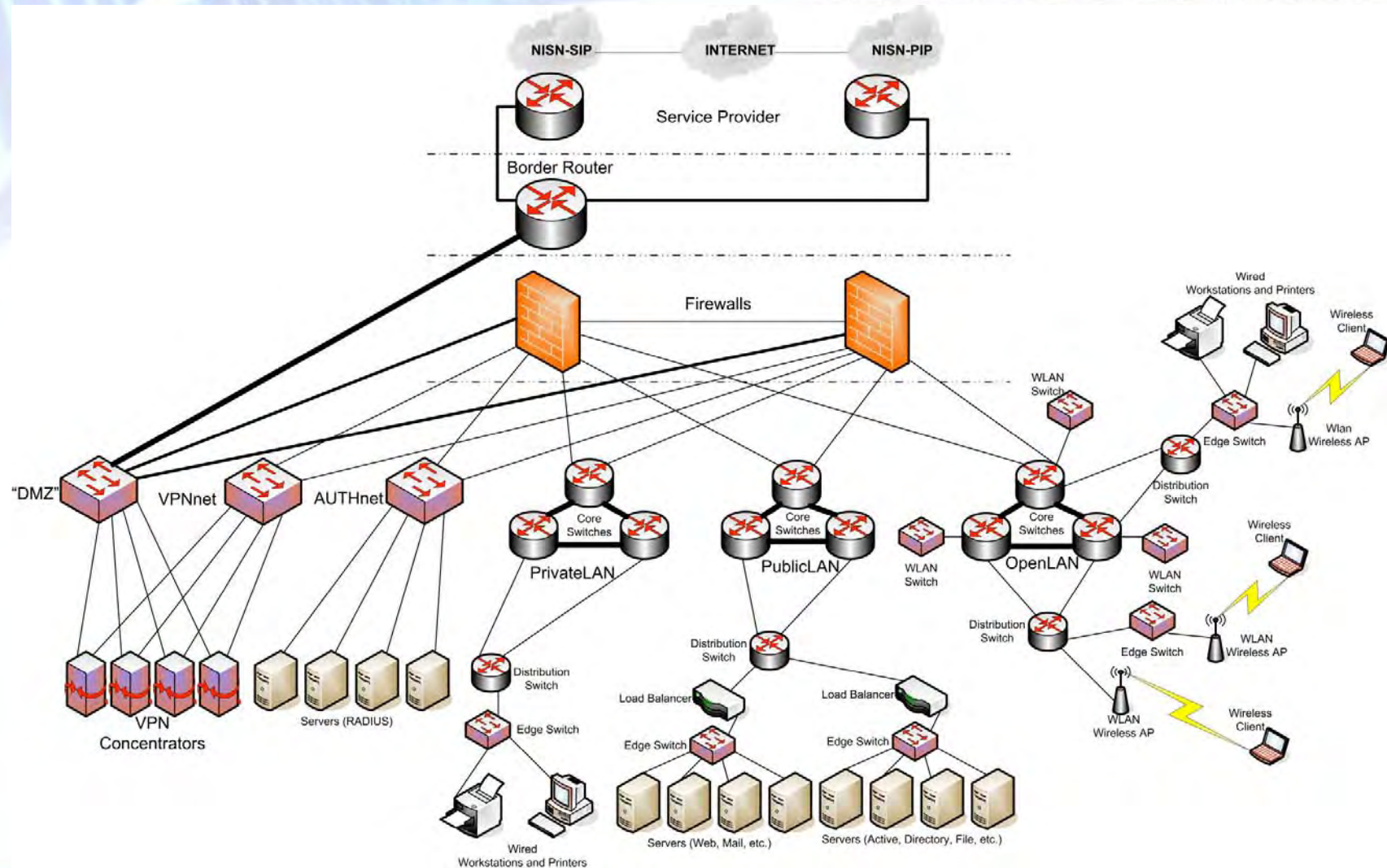
- ARCLAN covers 80+ buildings
- Comprised of 3 physically separate LANs – Private, Public and Open
  - Private – client network; most populated; limited inbound access
  - Public – server network; least populated; limited inbound access
  - Open – catch all client/server network; heavy reliance on host-based firewalls
- Wireless network built on ARCLAN Open infrastructure
- 3 Core locations in N233, N240 and N229
- About 7,500 active ports
- 14,000 registered IPs





# ARCLAN High-Level Schematic

Office of the Chief Information Officer





## ARCLAN - Firewall/Border/DMZ

Office of the Chief Information Officer

- ARC Border router serves as a BGP peering point for other ARC networks (NAS, DARWIN, NREN)
- DMZ and Border devices provide security, using IP Access Control Lists (ACLs) and IP connectivity to and from the Internet
  - DMZ also serves as the aggregation point for the different LAN types (Private, Public and Open)
  - The ARC DMZ switch is the connection point for external devices (ARC-BORDER-RTR, VPN, MCU, ARCLAN firewalls)
- Two sets of firewalls: one serving ARCLAN Open, and one serving ARCLAN Private and Public



# ARCLAN Components

Office of the Chief Information Officer

- The ARCLAN firewalls connect to ARCLAN core devices on each security domain
- Typical Core-Distribution-Access (CDA) layer architecture:
  - The ARCLAN core devices connect redundantly to ARCLAN distribution layer devices
  - ARCLAN distribution layer devices connect to ARCLAN edge devices
- Internet Protocol Address Management (IPAM) System
  - Managed by NISN at MSFC





## ARCLAN - Wireless

Office of the Chief Information Officer

- The ARC WLAN provides 802.11a/b/g wireless networking services to ARC
- It centralizes Wireless Access Point (WAP) administration with Aruba Networks controllers
- Provides coverage in 80% of buildings
- 401 access points/air monitors installed
- It authenticates ARC users and guest users (ARC-WLAN/ARC-WLAN-GUEST, or nasa/nasa-guest)
- It enforces use of encryption for services not already encrypted



# ARCLAN - VPN/Virtual Extranet/RADIUS

Office of the Chief Information Officer

- Cisco VPN services terminate encrypted client tunnels from the untrusted Internet to ARCLAN Private
- Juniper SSL-VPN Gateway appliances are based on TLS/SSL (HTTPS) instead of IPSEC
  - This web-based alternative deploys an HTTPS Web rewrite proxy capability to intranet Web servers, retrieving/forwarding NASA content that the user is eligible to see
  - These appliances also serve as protocol converters
- RADIUS provides an authentication front end for ARC services (e.g., WLAN, VPN, Neoteris, and ARCLAN Routers)



# ARCLAN Capabilities

Office of the Chief Information Officer

- ARCLAN provides 100Mbps service to the desktop
- Access layer to Distribution layer uplinks are generally 100Mbps
- Distribution-Layer-to-Core-Layer uplinks:
  - gigabit
  - redundant at Layers 2 and 3,
  - use OSPF and RSTP network routing protocols
  - diverse to two different core devices
- Core-to-Core links are redundant at L2 and utilize RTSP and are "bonded" in a trunk-switch configuration





## ARCLAN Capabilities (cont.)

Office of the Chief Information Officer

- ARCLAN Private core switches are interconnected using (4) gigabit connections "bonded" in a trunk-switch configuration
- ARCLAN Public core switches are interconnected using (2) gigabit connections "bonded" in a trunk-switch configuration
- ARCLAN Open core switches are interconnected utilizing (2) gigabit connections "bonded" in a trunk-switch configuration
- In each Core building (N233, N240, and N229), there are three Core switches — one for each security domain (Public, Private, Open)



## ARCLAN Capabilities (cont.)

Office of the Chief Information Officer

- Core elements consist of Foundry BigIron 8000 chassis with dual redundant management cards
- The distribution layer consists largely of Foundry 4802's which provide dual gigabit uplinks to the cores, and 48 ports of 10/100Mbps copper
- There are also Cisco devices at the distribution layer, which provide "distributor" capability
- For buildings that do not have full "distributor" capability, a 100M or gigabit fiber is fed from a "distributor" in another building to provide ARCLAN service.
  - Remote distributors are generally 3500/4500 series Cisco devices



## ARCLAN Capabilities (cont.)

Office of the Chief Information Officer

- The access layer of ARCLAN is generally populated by Cisco 2xxx/3xxx series switches, with a few legacy shared media devices (hubs) still remaining
- There is a mix of 10/100Mbps and 10/100/1000Mbps switches that generally provide copper connectivity to the desktop
- The 10/100/1000Mbps switches represent less than 5% of the total switches deployed





# Network & Configuration Management

Office of the Chief Information Officer

- CA Spectrum software is used to manage the availability and performance of the ARC network
  - Automatic discovery of network elements, services and customers
  - Proactively predicts and isolates problems to the root cause
- Internal configuration management system (CM)
  - Set of perl scripts and tools used to automatically track and report changes to configuration files for network
  - Changes are reported to the network engineers multiple times daily
  - Configuration changes can be pushed from a central location (CM)



## Voice Element

Office of the Chief Information Officer

- This is ARC's telephone infrastructure, through which the following are managed:
  - All telephone number assignments and features are managed through this element
  - The physical infrastructure that supports the origination, switching and termination of voice communications within the ARC campus, to other NASA centers, other Federal agencies and the general public switched telephone network.



## Voice Element — Equipment

Office of the Chief Information Officer

- The ARC Digital Telephone System (DTS) is a government-owned NORTEL, SL-100 system with two Remote Switching Centers (RSCs).
- Primary equipment used with the SL-100 are:
  - the NORTEL series M2000 and M5000 telephones
  - Unity Redial analog telephones
  - conference telephones
  - basic 2500 analog type telephones
  - Polycom speaker phones
  - NORTEL MADDO and DataPath units
- Two NORTEL consoles also provide operator assistance.





## Voice Element (cont.)

Office of the Chief Information Officer

- The DTS host is in Bldg. N263 and connects to RSCs in buildings M17 and M780 via active fiber optic backbone cable.
- SuperNode core (MSL-17) has ~ 9,000 ports in service.
- RSC in basement of M17 includes:
  - - Room 01A demarcation location (for NASA and ATT)
  - - Room 01B RSC, Rectifier, and RSC location
  - - Room 01C Data switch and FDU location
  - - Room 01D Telephone Cross Connect location
- RSC in M780 is used only as a remote telephone switch for phones located in buildings of the Moffett Federal Airfield. Both NASA and military facilities have phones in that area of the campus.



## Video Element

Office of the Chief Information Officer

- The Video/Audio Networks and Systems Engineering Group (VANSEG) provides:
  - Engineering design
  - Implementation and maintenance services for analog and digital based video infrastructures, systems, applications
  - Collaborative information-presentation systems that support ARC research and business activities
- VANSEG manages the Moffett video distribution network (VidNet) and coordinates service provisioning and infrastructure for Cable Television (CATV), Closed Circuit Television (CCTV), Digital Television (DTV), Digital Satellite Systems (DSS), and other video technologies and services
- VCC



# RF Radio Element

Office of the Chief Information Officer

- Operated out of building N158
- The Trunking Radio system provides a switched radio network for real-time voice communications
- It includes:
  - Enhanced Digital Access Communications System (EDACS) Radio Frequency (RF) switching unit
  - Associated support hardware (antennae, amplifiers, waveguide, etc.)
  - Customer-used radios and a management connection to the EDACS system





# RF Radio Element (Building N158)

Office of the Chief Information Officer





# Communications Network System Environment Overview

Office of the Chief Information Officer

- Primary components of the Communications Network System are located in ARC buildings N233, N254 (External Interface), N240, N229, N263 (Voice), M158 (RF Radio)
- Other components reside in any ARC location that has a communications point of presence and, via the wireless infrastructure, any location within the Center's radio range
- The secure areas housing the ARC Communications Network System are climate-controlled with raised computer floors
- All rooms have fire detection and sprinkler systems, and ABC-type fire extinguishers located throughout each facility





## System Environment Overview (cont.)

Office of the Chief Information Officer

- Each location has UPS power for at least 20 minutes
- N263 and N254 emergency generators support facilities and operations during utility power failure for up to 72 hours
- Unescorted access to NASA facilities is restricted to authorized personnel with appropriate identification
- All buildings housing primary ARC Communications Network System equipment have further security controls: standard locks/keys visitor sign-in and escort at all times
- Individual rooms with equipment are secured by cipher lock, plus visitor sign-in and escort at all times





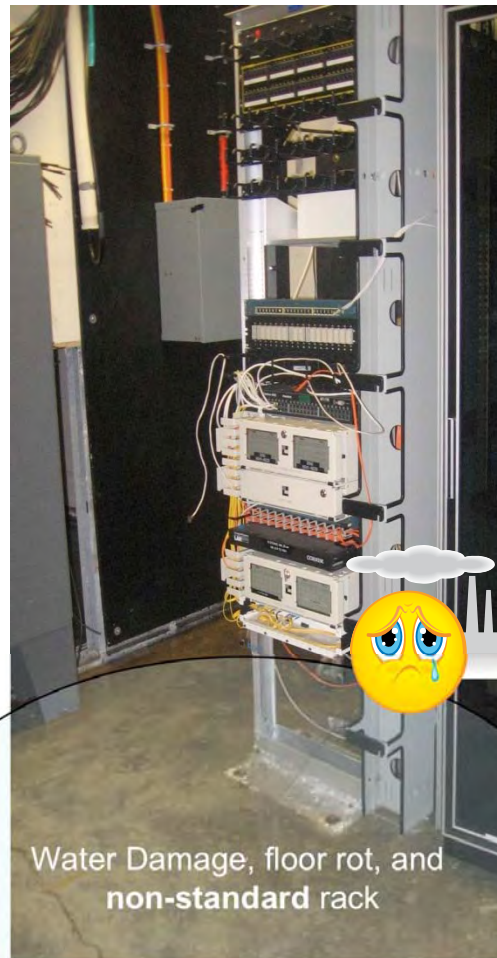
# CLOSET CONSIDERATIONS

Office of the Chief Information Officer

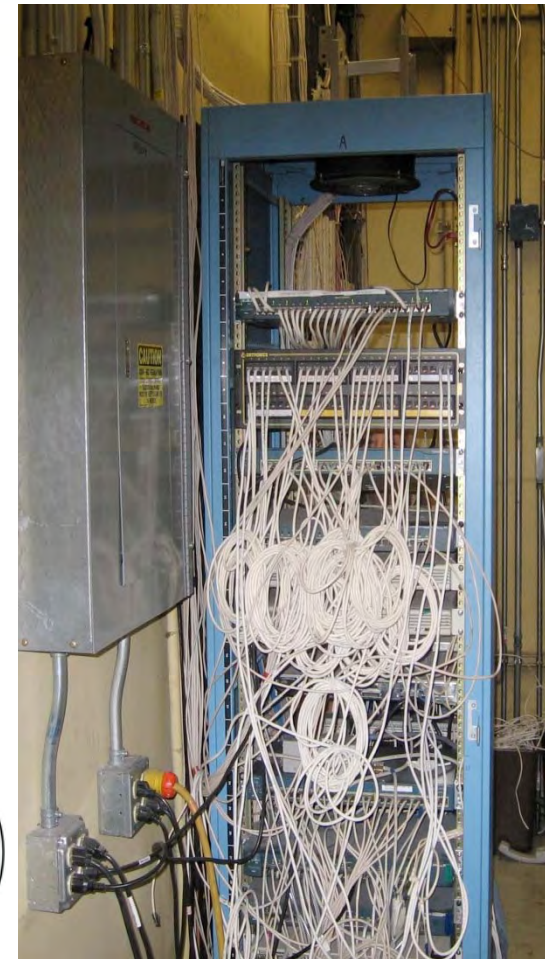
The Good



The Bad



The Ugly





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# Center IT Infrastructure Today

Office of the Chief Information Officer

## **ARC Data Center Environment**

**Mark Savi**

Lead for Data Center





# Primary Data Center Functions

Office of the Chief Information Officer

- Location for Code I Services
- Location for Other ARC Organizational Code Servers



# Operations Command Center ("Tier 2 Ops")

Office of the Chief Information Officer

- Problem resolution for significant failures, and communication, coordination, and documentation during Data Center incidents
- Surveillance monitoring
- Service monitoring (e.g., servers, devices, apps)
- Reporting (daily, weekly, monthly, quarterly, annually)
- Number of new systems in/out
- UPS load
- System / service availability metrics
- Scheduled/non-scheduled activities
- All Data Center issues



# Data Center Monitoring Capability

Office of the Chief Information Officer

- Human Monitoring
  - Operations staff 24x5
- Technology Monitoring
  - IP Monitor
  - Network drivers, servers, disk space, and Uninterrupted Power Supply (UPS)
    - Automated email and text messaging alerts set up for designated Points of Contact (POCs)
  - Other monitoring tools: Networking and Storage Area Networks (SAN)





## Selected Services Located in the Data Center

Over 400 physical and virtual servers, devices, Information Officer

technologies, and applications for running critical services for Code I and other organizations, as well as systems and hardware of several other systems under other organizational codes; of critical importance are the following services and systems:

- *Windows Active Directory (AD) authentication* — Provides authorized access to Center and Agency services such as NASA Operational Messaging and Directory (NOMAD), SharePoint, Ames Wireless Local Area Network (ARC WLAN), the Ames Public File Share, and other network resources



## Selected Services (cont.)

Office of the Chief Information Officer

- *VMware environment* — Provides a virtualized lab infrastructure to groups that support important Center and Agency groups and projects, such as the ARC Office of the CIO, Application Services, Public Key Infrastructure (PKI), ODIN, and Constellation.
- *Storage Area Network (SAN)* — Provides storage for critical infrastructure groups across the Center, such as the ARC Office of the CIO, the Public Key Infrastructure (PKI), and the Application Services Group (ASG).
- *Web Hosting Services* — Includes all systems used to provide web hosting services for Center customers



## Selected Services (cont.)

Office of the Chief Information Officer

- *Data Backup Infrastructure* — Backs up servers (running various operating systems) that support key groups across the Center, including the OCIO, PKI, Network Operations Center (NOC), Constellation groups, and others
- *IP Monitor* — Availability monitoring and alerts for Code I servers and other groups; the 3 IP Monitor servers monitor a total of about 760 services
- *Center SMTP Mail Relays* — All email traffic from within the Center
- *SecurID Services* — All systems used to provide RSA SecurID Services





## Selected Services (cont.)

Office of the Chief Information Officer

- *NetBotz* — Physical security and environmental monitoring
- *Microsoft Project Server and Microsoft Office SharePoint Services (MOSS)* — Support over 100 sites and about 1,500 users
- *Windows File Share Services* — Include primary and secondary cluster nodes



# Data Center Rooms

Office of the Chief Information Officer

- Bldg. 233, Room 150
- Bldg. 233, Room 165
- Bldg. 233, Room 170
- Bldg. 233, Room B8
- Bldg. 254, Room 131



## Building N233, Room 150

Office of the Chief Information Officer

- Function: Supports the Network Operation Center
- Physical: 950 sq. ft.
- Electrical:
  - UPS#1 rated at 40KW, operating at 22KW
  - Maximum capacity is 32KW (80% of threshold)
  - Existing cabinets = 17 (assumed draw per cabinet: 3-5KW)
- Cooling:
  - In-space cooling unit (ISU) #15, maximum capacity 15 tons
  - Current estimated load = 6.3 tons
  - Estimated maximum increase and still maintain ISU efficiency = 6 tons
- Fire Suppression: zoned, dry pipe system





## Building N233, Room 165

Office of the Chief Information Officer

- Function: Combines with Room 170 (next slide) as Primary Data Center — about 400 servers in both rooms
- Physical: 1900 sq. ft
- Electrical:
  - UPS#2 rated at 120KW, operating at 80% capacity
  - Non-UPS load approx. 6KW, supplied by building panel #1200
  - Existing cabinets: 34 on UPS and 2 on panel #1200; physical space would allow 6-8 additional cabinets: 1 UPS, about 7 non-UPS
- Cooling:
  - ISU #s12, 13, 14; maximum capacity 40 tons (1 ISU for backup)
  - Current estimated load: 20 tons
  - Estimated maximum increase and still maintain ISU efficiency:10 tons
- Fire Suppression: zoned dry pipe system



## Building N233, Room 170

- Function: Combines with Room 165 (previous slide) as Primary Data Center; about 400 servers in both rooms
- Physical: 1930 sq. ft.
- Electrical:
  - UPS#2 rated at 120KW, approx. 70/20 split with Room 165
  - Existing cabinets: 11 on UPS#2 and 7 in non-UPS Development Area (powered by building panels #1100 and #1200)
  - 25-30 cabinets could be added in physical space, but only 1 to UPS, and 4 to building panels
- Cooling:
  - ISU #11; maximum capacity 15 tons
  - Current estimated load: 8.5 tons
  - Estimated maximum increase and still maintain ISU efficiency: 2.5 tons
- Fire Suppression: zoned dry pipe system



## Building N233, Room B8

Office of the Chief Information Officer

- Function: houses 40-60 production servers that support the ODIN infrastructure
- Physical: about 250 sq. ft.
- Electrical: Servers are fed from building electrical distribution panel
  - No Building UPS
- Cooling:
  - (1) ISU, which is rated at 8 tons
- Fire Suppression: Sprinkler system





## Building N254, Room 131

Office of the Chief Information Officer

- Function: Tier 2 Data Center facility with generator power and direct access to Agency and Internet
- Physical: about 3,200 sq. ft.
- Electrical:
  - Direct connection to primary substation. Approx. 18KV
  - Two generators: 540KW (>2 x anticipated load); 480KW (2x a.l.)
- Cooling:
  - 3 chillers in Building 254
  - Each room has redundant ISUs
- Fire Suppression: zoned dry pipe system



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# Center IT Infrastructure Today

Office of the Chief Information Officer

## **ARC End User Environment**

**Ray Obrien**

Lead for Desktop Computing  
and Mobile Communications





# ARC End User Environment Overview

Office of the Chief Information Officer

- End User Services provided by ODIN
  - Desktop computing support
  - Email and calendaring services
  - Mobile communications services
  - Web conferencing
- End User Services also provided by other contracts
  - Desktop computing support



# ARC End User Environment

## Current ODIN Scope of Services

Office of the Chief Information Officer

- Desktop support for PCs and Macs
- Support for small Center application software overlay
- Help Desk
- Printer services provided as part of desktop offering
- Periodic Hardware Refresh (3 yr)
- Software Support and Periodic Software Refresh
- Electronic catalog of Services and Components
- Webex services
- NOMAD Email and calendaring services
- Cell, hand-held mobile, and pager communications services
- 2/3 of ODIN subscription is in institutional organizations



# ARC End User Environment

## Services Currently Provided by Other Contractors

Office of the Chief Information Officer

- Desktop support for PCs and Macs supporting:
  - Instruments
  - Simulators
  - Facilities (wind tunnels, ARCjets, etc.)
  - Specialized applications in science and engineering organizations
- Linux and Unix platforms
- Support for the above typically provided by level-of-effort contracts managed by the project, facility, or organization





# ARC ODIN Computer Seats Quantities by Operating System

Office of the Chief Information Officer

TYPE	COUNT
• Windows XP	1,100
• Mac OS X	800



## ARC Seat Quantities - ODIN

Office of the Chief Information Officer

TYPE	TOTAL (approx.)
• Desktop or Workstation Seats	1100
• Laptop Seats	800
• NOMAD Account Seats	2000
• Blackberry Seats	180
• Windows Mobile Seats	50
• Treo Seats	90
• Cell Phone Seats	190
• Pager Seats	160
• Webex Seats	50



# ARC End User Service Standards

Office of the Chief Information Officer

- ODIN Desktop Seats
  - Monitor – 17" LCD (Desktop seats)
  - Return To Service – SLA of 8 working hours
  - Hardware refresh – 3 years
  - Email – 400 MB mailbox
  - Local Data backup and restore services – user data backup performed daily (desktops only)
  - Help Desk support – weekdays, 6:00 am – 6:00 pm
- ODIN MC1/2/3 (Blackberry, TREO, Windows Mobile) and PCELL (cell phone) Seats
  - Return To Service – SLA of 8 working hours
  - Hardware refresh – 18 months
  - Help Desk support – weekdays, 6:00 am – 6:00 pm





# ARC End User Service Standards

Office of the Chief Information Officer

- ODIN Laptop Seats
  - Standalone by default
  - Combo option (comes with LCD, keyboard, mouse, speakers)
  - Other services provided same as for desktop seat



## ARC End User Service Standards (cont.)

Office of the Chief Information Officer

- Webex Virtual Team Meeting - about 45 seats
  - Standard – Small 480 minutes per month to be used by anyone who dials in on the Webex number
- NOMAD - about 4,000 accounts
  - Integrated email, calendar, task management, to-do list, address book
  - On the desktop via Outlook (for Windows) and Entourage (for Macintosh)
  - Large number of users choose other desktop email clients, such as AppleMail and Thunderbird
  - Full feature set also available for handheld devices (BlackBerry, Treo and Windows mobile devices)



# ARC ODIN (PC/Windows) Standard Software Load

as of 5/1/09

Office of the Chief Information Officer

- Microsoft Windows XP SP3
- Microsoft Office 2003
- Internet Explorer 7
- Symantec Anti-Virus 10.1.x
- Adobe Acrobat Reader – .8.1.2
- Win-Zip 11.1
- Timbuktu 5.0x
- Media Player 11.0.x
- Real Player 6.0.12.1663
- Flash Player 9.0.x
- Authorware Player 2004,0,0,73
- Mozilla FireFox 2.0.0.16
- Entrust 7 (PKI )
- QuickTime 7.5.x
- Filenet eForms 4.2
- Citrix ICA Client 10.1.5
- .NET 2.1.x
- SMS Client 2.5
- Patchlink 6.4.0.3178
- SAP 6405.5.18.1016
- SRP Helper 2.1.1.0
- Webex 929.2005.3.20





# ARC ODIN (Mac) Standard Software Load

as of 5/1/09

Office of the Chief Information Officer

- Mac OS X 10.5.x
- Microsoft Office 2004/  
Entourage Messaging
- Safari 3.1.2
- Symantec Antivirus 10.2
- Adobe Acrobat Reader 8.1.2
- Stuffit Expander (Stuffit Deluxe) 10
- Timbuktu Pro 8.7
- Flip4Mac 2.2.0.49
- Real Player
- Flash Player 9.0.x
- Authorware Player
- Mozilla Firefox 2.0.0.15
- Entrust 6.2.1 (PKI )
- QuickTime
- Java Virtual machine 12.1.0
- FileNet Desktop eForms 5.0
- Citrix ICA Client 10.0.0
- Patchlink 6.4.185
- LanREV Agent 4.6.4
- SAPGUI 7.10
- SRP Helper 1.3.0



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# Center Tour

Office of the Chief Information Officer

- Access to the Center is by Tour bus only (~20 passengers/bus).
- All visitors to the center must wear badges that are to be provided; pick up badges at the registration desk prior to boarding bus.
- Please do not leave personal items in the ballroom unattended.
- There will be some steps to climb.
- Approximately 1/2 mile of walking can be anticipated.



# Center Tour Schedule

Office of the Chief Information Officer

- Projected length of tour is 1 hour
- First bus will begin boarding at 11:15 am
- First bus will leave at 11:30 am
- Second bus will begin boarding at 11:45 am
- Second bus will leave at at 12 pm
- Third bus will begin boarding at at 12:15 pm (if needed)
- Third bus will leave at 12:30 pm (if needed)





## Center Tour Behavior

Office of the Chief Information Officer

- Do not use cell phones or cameras to take pictures; pictures and charts will be available later on the I<sup>3</sup>P website ([I3P.nasa.gov](http://I3P.nasa.gov)).
- Please refrain from talking with employees you may see working in the tour areas.